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Dendrocoelopsis kishidai sp. nov., a New Freshwater
Planarian from Kyoto, the Kinki District, Honshu

With 5 Text-figures

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ABSTRACT A new species of the genus *Dendrocoelopsis* (Turbellaria, Tricladida, Paludicola), *D. kishidai* Kawakatsu, sp. nov., from Kyoto, the Kinki District, Honshu, Japan, is described. This pigmented and two-eyed new species with a moderately developed adhesive organ is conspicuous for its highly asymmetrical penis papilla, rather wide ejaculatory duct, thick muscular layer surrounding the penis lumen, and weakly developed vagina.

A close re-examination of the material of freshwater planarians accumulated in the senior author's laboratory has furnished the occasion to prepare this article. It was already reported in his previous papers that a dendrocoelid species, *Bdellocephala brunnea* Iijima et Kaburaki, occurred in the locality of the Nishiōji stock of the sexual race of "Dugesia gonocephala" (i.e., *Dugesia japonica* Ichikawa et Kawakatsu) from Kyoto City (cf. Okugawa, 1955, 1957; Okugawa and Kawakatsu, 1954 a, b; see also Sugino, 1936¹). After examining serial sections of the animals from this locality recently prepared by the senior author, he has come to the conclusion that the materials of the dendrocoelid consist of two species; one is *Bd. brunnea* and the other is an undescribed species of the genus *Dendrocoelopsis*.

In the present paper, this new triclad turbellarian from Central Japan will be described by the senior author, together with some ecological remarks observed by himself and the junior authors. The authors take pleasure in naming this new

1) The materials used in Dr. H. Sugino's heteroplastic transplantation experiments on *Bdellocephala brunnea* and "Planaria gonocephala" were collected at this locality (pers. comm.).

species after Dr. Yoshikazu Kishida, Professor of Kanazawa University of Japan, in honor of his valuable contribution to the planarian regeneration.

COLLECTION DATA AND THE SAMPLES EXAMINED

Specimen Lot No. 10 C group. Two sexually mature specimens were found in the samples collected from a spring-fed field for the Japanese parsley, Nishiōji-Shichijō, the southwestern part of Kyoto City (water temp., 14–17°C). Altitude, 22 m. May 3, 1951. Coll. M. Kawakatsu. Cf. Kawakatsu, Ōgawara and Tarui, 1967; Okugawa and Kawakatsu, 1954 a, p. 25.

The animals were fixed in Carnoy's fluid. Sagittal serial sections were stained with Delafield's haematoxylin and erythrosin.

DESCRIPTION OF THE NEW SPECIES

Order TRICLADIDA

Suborder PALUDICOLA or PROBURSALIA

Family Dendrocoelidae

Genus *Dendrocoelopsis* Kenk, 1930

Dendrocoelopsis kishidai Kawakatsu, sp. nov.

[Japanese name: Kyōto-uzumushi]

Description. According to the senior author's field notebook, dendrocoelid animals of both the blackish and brownish types had usually been collected in the Nishiōji locality. It is supposed that the former is *Bdellocephala brunnea* and the latter is the present new species.

This is a middle-sized to rather large and pigmented epigean species. Its body shape is a typical dendrocoelid type and is very similar to that of *Bd. brunnea* (cf. Kawakatsu, 1969, p. 91, pl. 8, fig. 17). The anterior end of the head becomes subtruncated with a slightly convex frontal margin, having a moderately developed subterminal adhesive organ in the usual ventral position. Two eyes, each surrounded by a round, pigment-free ocular area, are situated on the dorsal side of the head. The ground color of the dorsal surface of body is uniformly dark brown.

Judging from the sagittal sections, the large pharynx is inserted behind the middle of the body. The genital pore is situated at the level of the middle of the postpharyngeal region. The anterior intestinal trunk has 10 to 12 short lateral branches on each side; each posterior trunk has 15 to 18 short lateral branches. The external muscle zone of the pharynx consists of three layers, i.e., an outer thin layer of longitudinal fibres, a middle thick layer of circular ones, and an inner thin layer of longitudinal ones. The internal muscle zone shows the typical arrangement of musculatures of the family Dendrocoelidae (Fig. 3 A).

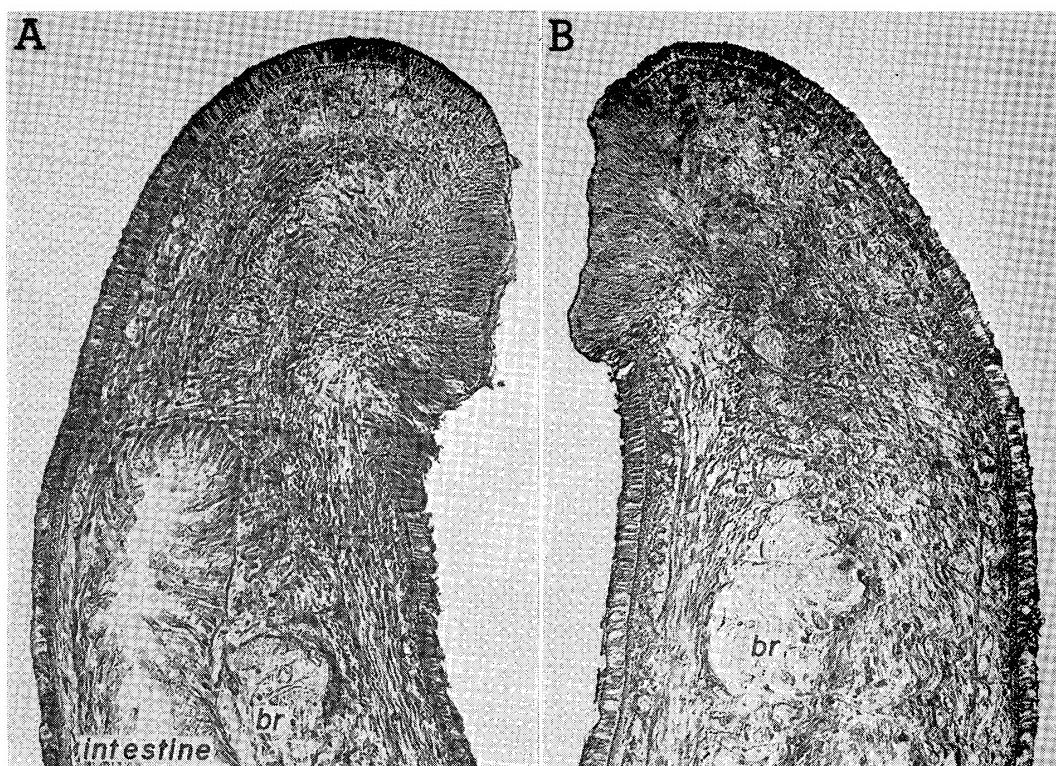


Fig. 1. *Dendrocoelopsis kishidai* sp. nov. Photomicrographs of sagittal sections of the adhesive organ or sucker of two specimens. A, Specimen No. 10 C-a (holotype). B, Specimen No. 10 C-b (paratype). br, brain.

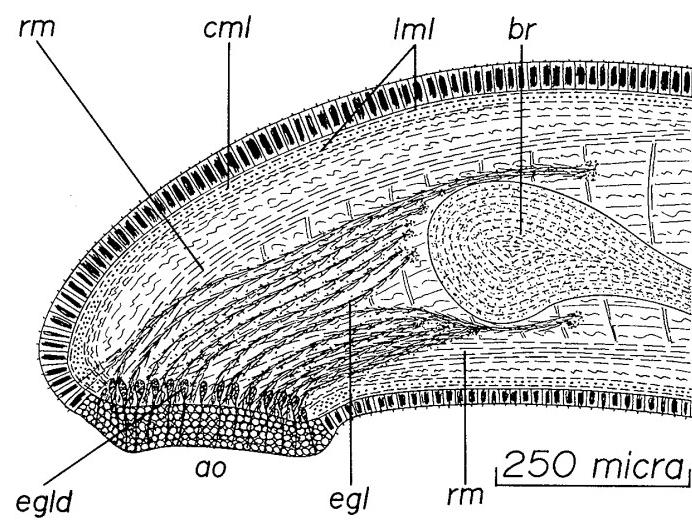


Fig. 2. Sketch of the adhesive organ of *Dendrocoelopsis kishidai* sp. nov. drawn from sagittal sections (Specimen No. 10 C-b, paratype). ao, adhesive organ; br, brain; cml, circular muscle layers; egl, erythrophilic glands; egld, erythrophilic gland ducts; lml, longitudinal muscle layers; rm, retractor muscle fibres.

The adhesive organ or sucker of the present new species is more developed than that of *Bdellocephala borealis* Kawakatsu, 1978, illustrated in a paper by Kawakatsu, Asai and Yamada (1978, pp. 84–85, figs. 3 A–D, 4). The surface of the organ is covered with numerous erythrophilic gland ducts. The cell bodies of the glands are scattered through the mesenchyme of the anterior part of body. The retractor muscle fibres are moderately developed (Figs. 1 A, B, 2). The marginal

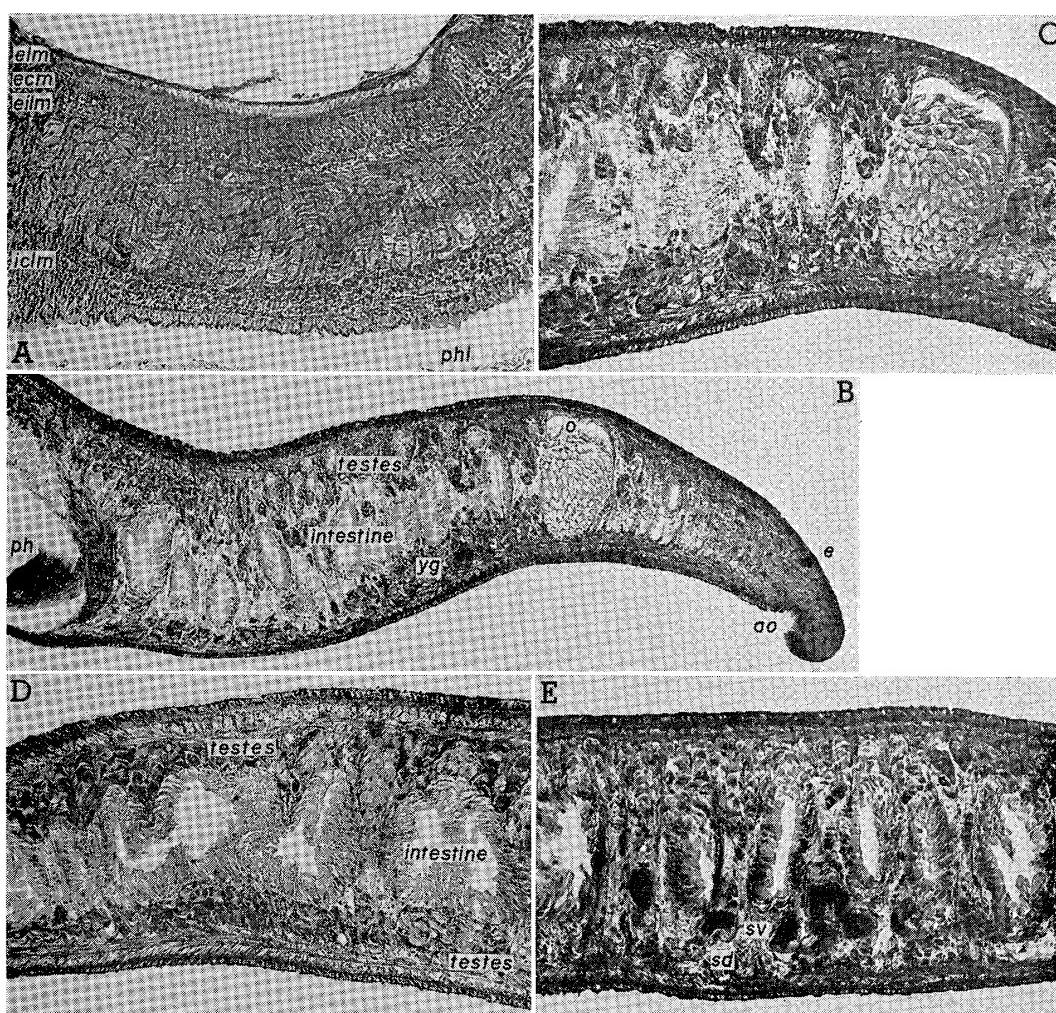


Fig. 3. *Dendrocoelopsis kishidai* sp. nov. — A. Photomicrograph of a sagittal section of a part of pharynx (Specimen No. 10 C-a, holotype). — B-E. Photomicrographs showing parts of the genital organs. B, Near mid-sagittal section of the prepharyngeal region (holotype). C, Enlarged photograph of the anterior part of B. D, Near mid-sagittal section of the prepharyngeal region (Specimen No. 10 C-b, paratype). E, Near mid-sagittal section of the anterior part of the postpharyngeal region (holotype). ao, adhesive organ; e, eye; ecm, external circular muscle layer; eilm, external irregular longitudinal muscle layer; elm, external longitudinal muscle layer; iclm, internal circular and longitudinal muscle layers; o, ovary; ph, pharynx; phl, pharynx lumen; sd, sperm duct; sv, spermiducal vesicle; yg, yolk glands.

adhesive zone is well developed in the present new species.

A pair of very large ovaries occur on the ventral side of the anterior region between the third and the fourth intestinal diverticula. They occupy almost the entire dorso-ventral diameter of the parenchyma of the body (Fig. 3 B, C). The yolk glands (or vitellaria) are distributed throughout the body in the surrounding parenchyma (Fig. 3 B-D).

The testes are moderate in size, numerous, and essentially dorsal in position (Fig. 3 B, C). Some testes are also found in the ventral position (Fig. 3 D). They

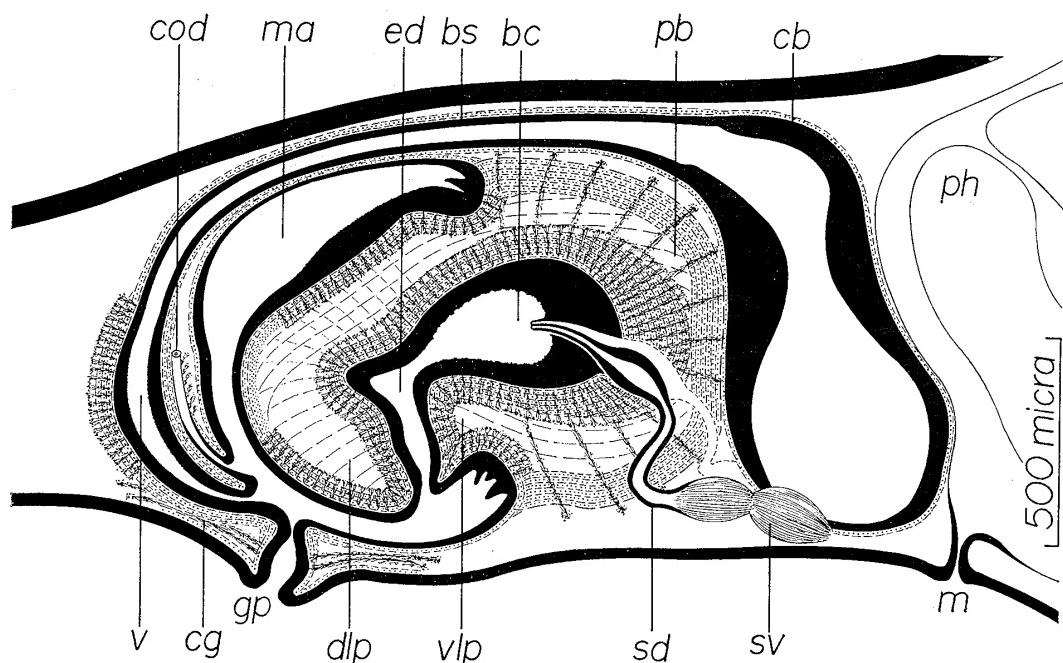
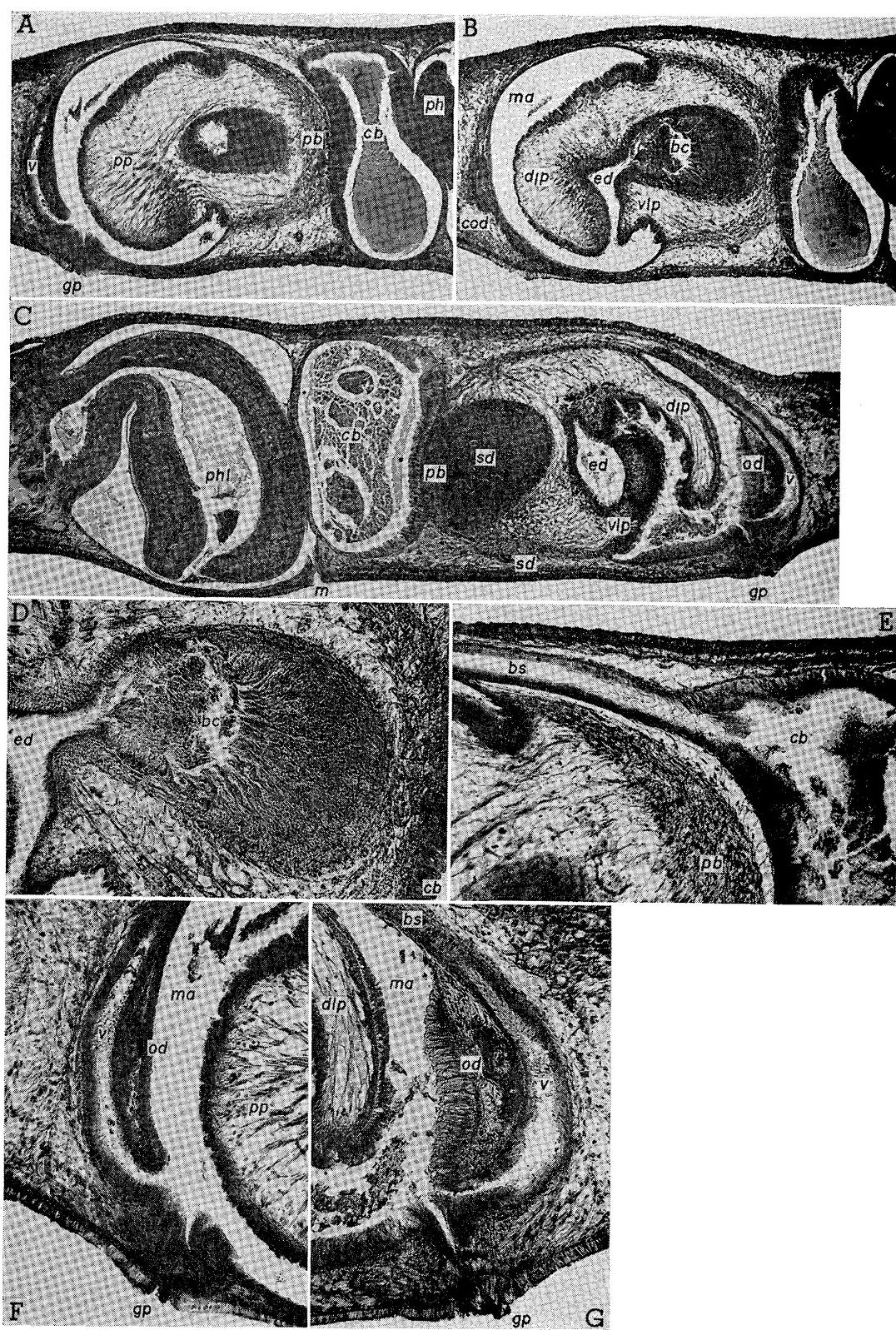


Fig. 4. Diagram showing the sagittal view of the copulatory apparatus of *Dendrocoelopsis kishidai* sp. nov. (Specimen No. 10 C-a, holotype). bc, bulbar cavity; bs, bursa stalk; cb, copulatory bursa; cg, cement gland; cod, common oviductine duct; dlp, dorsal lip of the penis papilla; ed, ejaculatory duct; gp, genital pore; m, mouth; ma, male genital antrum; pb, penis bulb; ph, pharynx; sd, sperm duct; sv, spermiducal vesicle; v, vagina; vlp, ventral lip of the penis papilla.

Fig. 5. Photomicrographs showing parts of the copulatory apparatus of *Dendrocoelopsis kishidai* sp. nov. — A-C. Near mid-sagittal sections of the copulatory apparatus of 2 specimens. Same magnifications. A and B, Specimen No. 10 C-a (holotype). C, Specimen No. 10 C-b (paratype). Notice the tangled mass of sperm found in the copulatory bursa. — D-G. Enlarged photographs of parts of the copulatory apparatus. D, bulbar cavity (holotype). E, Bursal canal (holotype). F, Vagina (holotype). G, Vagina (paratype). bc, bulbar cavity; bs, bursa stalk; cb, copulatory bursa; cod, common oviductine duct; dlp, dorsal lip of the penis papilla; ed, ejaculatory duct; gp, genital pore; m, mouth; ma, male genital antrum; od, oviductine duct; pb, penis bulb; ph, pharynx; phl, pharynx lumen; sd, sperm duct; v, vagina; vlp, ventral lip of the penis papilla.

New *Dendrocoelopsis* from Kyoto

151



are arranged on either side of the midline in three to four longitudinal zones extending from the posterior level of the ovaries to the nearly posterior end of the body. The total number of testes can be estimated at about 300 to 400. The sperm ducts form a well-developed spermiducal vesicle packed with sperm on either side of the postpharyngeal region between the mouth and the anterior level of the penis bulb (Fig. 3 E). On the posterior side of the copulatory bursa, each sperm duct ascends vertically, then becomes a conspicuously expanded, thick-walled tube at the antero-lateral side of the penis bulb and again narrow to a slender duct, and opens into the bulbar cavity separately (Fig. 4).

The sagittal view of the copulatory apparatus of a specimen (holotype) is shown in Fig. 4. Photomicrographs of the copulatory apparatus of two specimens (holotype and paratype) are shown in Fig. 5 (A-G).

The penis has a considerably large, hemispherical bulb embedded in the parenchyma, and a very large papilla of an asymmetrical form, projecting into the male genital antrum (Figs. 4, 5 A-C). Both the bulb and the papilla are highly muscular in nature. The bulb is surrounded by a conspicuous muscular coat consisting of intermingled longitudinal and circular fibres (Figs. 4, 5 A-D). It contains a wide ovoid cavity (bulbar cavity or seminal vesicle), into which a pair of sperm ducts enter closely together from the antero-lateral sides. The bulbar cavity continues to the papilla as a rather wide ejaculatory duct. The anterior one-third of the penis lumen is lined by a very thick, highly glandular epithelium; in the remaining part of the lumen, the glandular epithelium becomes thinner than that of the anterior section. The bulbar cavity is surrounded by a well-developed muscular coat consisting of intermingled longitudinal and circular fibres (Figs. 4, 5 D). Numerous gland ducts filled with granules heavily stained with erythrosin are found around the penis lumen (Fig. 4).

The penis papilla is highly asymmetrical in shape. Its dorsal lip is very long; the ventral lip is rather short. Therefore, the ejaculatory duct opens at the ventral side of the tip of the papilla (Figs. 4, 5 B, C). The outer wall of the papilla is covered with a numerous, cubical epithelium which becomes thinner towards the tip. The subepithelial musculature consists of intermingled longitudinal and circular fibres. In the middle part of the dorsal lip of the papilla, the circular muscle fibres becomes slightly thicker than the other parts (Figs. 4, 5 A, B).

The male genital antrum is a wide, round cavity and opens to the genital pore postero-ventrally. It is closed with a thin, nucleate epithelium below which there are two muscle layers, one thin longitudinal and the other thin circular. The male antrum receives very long common ovovitelline duct at the roof of its posterior region close to the opening of the vagina (Figs. 4, 5 B, F, G). The common genital antrum is not conspicuous in the slides examined (Figs. 4, 5 A-C).

The copulatory bursa is a large-sized organ and is somewhat irregularly lobed. It occupies the entire dorso-ventral space between the posterior part of the pharyngeal chamber and the anterior part of the penis bulb (Figs. 4, 5 A-C). Its

lumen is lined with a tall, glandular epithelium (a tangled mass of sperm was found in the organ of the specimens examined) (Fig. 5 A-C). The bursa stalk is a long duct and opens into the male genital antrum near the genital pore (Figs. 4, 5 A, C, F, G). The bursal canal is lined with a rather thin glandular epithelium of a nucleate type. The muscular coat surrounding the bursa stalk consists of a thin layer of longitudinal fibres, a thin layer of circular and a thin layer of longitudinal. In the posterior one-third to one-fourth section of the bursa stalk, the glandular epithelium of the bursal canal becomes slightly thicker than that of the other parts and forms a weakly developed vagina accompanying numerous ducts of erythrophilic glands. The muscular coat surrounding the vagina consists of intermingled longitudinal and circular fibres (Figs. 4, 5 E-G). Weakly erythrophilous cement glands are developed near the genital pore.

The cocoon of the present new species is not known.

Type-series. Holotype. One set of sagittal serial sections (Specimen No. 10 C-a; 6 slides) will be deposited in the Department of Zoology, National Science Museum (Nat. Hist.), Tokyo. One paratype (No. 10 C-b, sagittal sections) is preserved in the senior author's laboratory (Fuji Women's College, Sapporo) as a borrowed material from the Museum.

Locality. A spring-fed water at Nishiōji-Shichijō, the southwestern part of Kyoto City, the Kinki District, Honshu. Altitude, 22 m. Collected by M. Kawakatsu on May 3, 1951.

Differential diagnosis. The taxonomy of the *Dendrocoelopsis* species is already discussed in the previous paper (cf. Kawakatsu, Asai and Yamada, 1977, pp. 210-213). The present new species, *D. kishidai*, is the fifth pigmented and two-eyed species with an adhesive organ. Externally and anatomically, this new species is easily distinguishable from the other two Japanese pigmented forms in the genus (*D. ezensis* Ichikawa et Okugawa, 1958, and *D. ichikawai* Kawakatsu, 1977) (cf. Kawakatsu, Asai and Yamada, *op. cit.*, p. 213).

Dendrocoelopsis kishidai differs from the other members of the genus in the following characters: living animal moderate to large in size and uniformly dark brown in color; head subtruncated with a convex frontal margin, and with round auricles; two eyes; subterminal adhesive organ moderately developed; testes essentially dorsal in position extending to the posterior end; hemispherical penis bulb considerably large and muscular with an ovoid bulbar cavity lined with a tall, glandular epithelium into which sperm ducts enter separately (spermiducal vesicles present); highly asymmetrical penis papilla (the dorsal lip is very long) containing a rather wide ejaculatory duct; with a thick muscular layer surrounding the penis lumen; long common ovovitelline duct entering the roof of the posterior part of the male genital antrum; copulatory bursa large, with a long bursa stalk, of which posterior one-third to one-fourth section forms a weakly developed vagina.

ECOLOGICAL NOTE

The type-locality of *Dendrocoelopsis kishidai*, the present new species, is the headwaters of a large spring that runs into a field of the Japanese parsley (*Oenanthe stolonifera*) (cf. Ichikawa and Kawakatsu, 1961, pl. 2, fig. 11; Kawakatsu, Ogawara and Tarui, 1967, p. 113, fig. 1, st. 7, p. 115, table 1). During the time when the authors were studying the ecological problems on *Dugesia japonica* in the laboratory of Kyoto Gakugei University (1950–1960), planarians were very common in this locality. The spot was also fed by a large quantity of pumped up underground water. The water temperature was about 14 to 17°C throughout the year. *Gammarus nipponensis* and a stickleback (*Pungitius sinensis kaibarae*) were very common (cf. Kobayashi, 1933, 1936). This locality has now disappeared, being taken over by the new housing project.

Among the three species of planarians that inhabited there, *D. japonica japonica* was the dominant form (the Nishiōji stock; cf. Kawakatsu, Ogawara and Tarui, 1967; Okugawa, 1955, 1957; Okugawa and Kawakatsu, 1954 a, b). *Bdellocephala brunnea* was also common. *Dendrocoelopsis kishidai* might not be a rare animal in this locality. But the authors did not lavish much care on the separation of those two dendrocoelid species as the experimental animals. The material used in the present study is from Kawakatsu's collection of paraffin samples of planarians prepared by himself in his former laboratory.

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